

Breeding in organic dairy production

Wytze J. Nauta



What is the best cow?

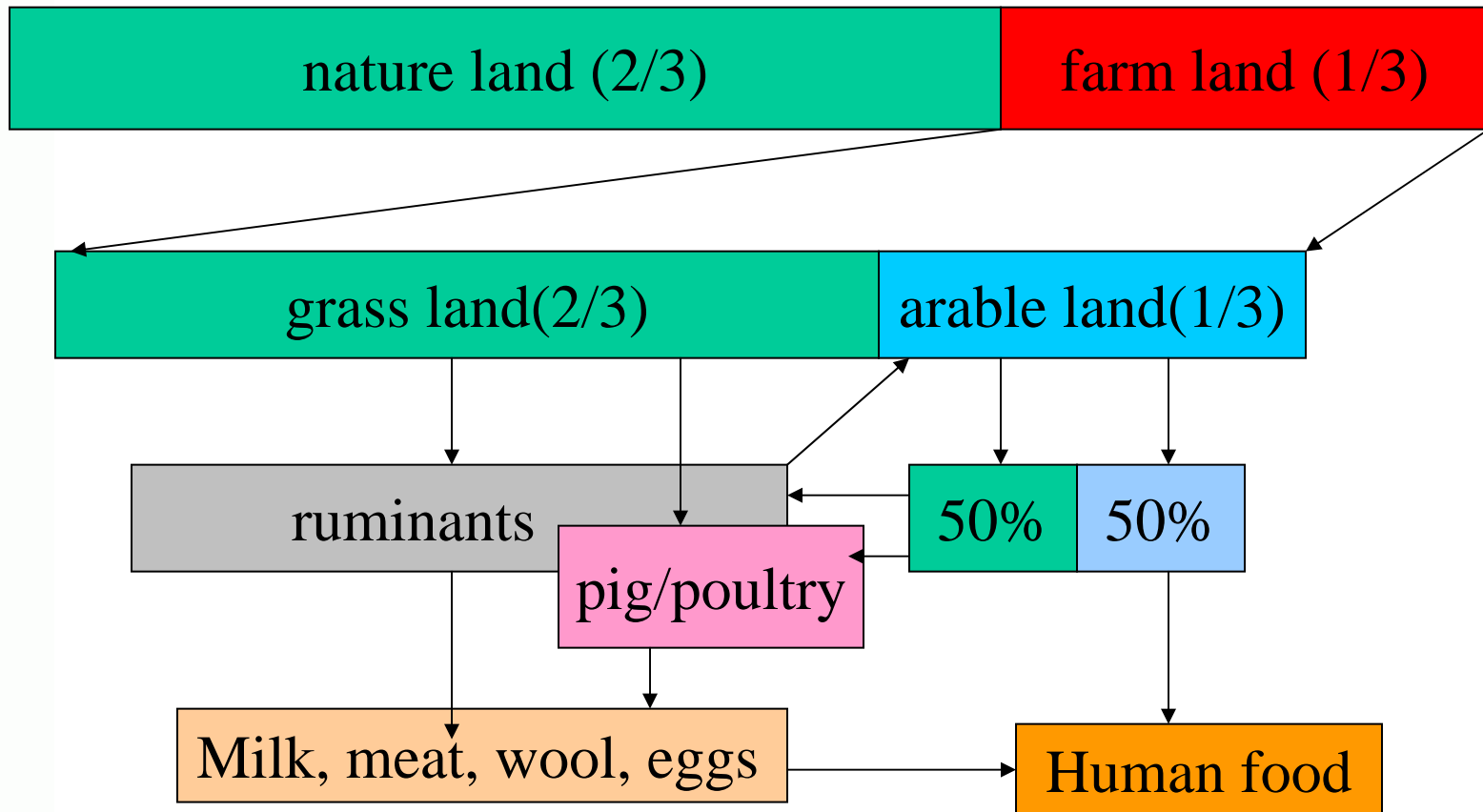
- Breeding:
 - Select the best cows and bulls and use them for production of next generation.
 - what is the best for organic?



Do we need a distinct organic breeding?

- Questions about:
 - Use and Adaptation of animals/type of animal
 - Reproduction technologies

World situation, Haiger, (1988):



Conventional production:

- High input (from all over the world)
- Maximum profit
- High yields per cow
- Optimizing housing and animals

Therefore:

- High concentrates level
- High milk quota / ha
- Holstein cows
- Free stalls with cubicles

Holstein:



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And using:

- AI and ET
- Superovulation, IVF
- Quantitative genetics
- Genomics
- Sperm sexing

→ For a short generation interval

Organic approach:

- Natural processes
- Animal integrity
- Balance in animal-plant production
- Animals that can adapt (robust)
- No ET and other reprod. Technol.
- No manipulation of animals

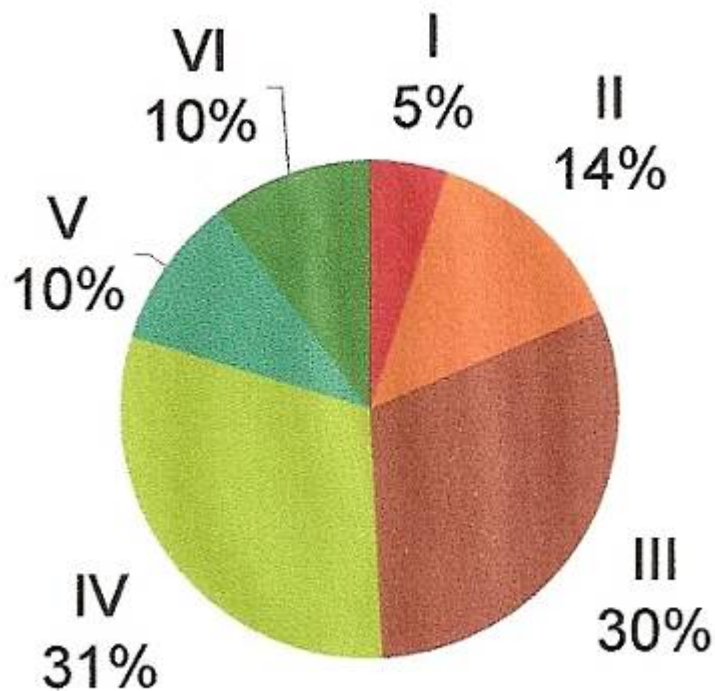
This means:

- Production from local resources
- No (or less) antibiotics
- Local/dual purpose breeds
- Horned cows, pigs with a tail
- Natural service ?

The PhD research:

1. Vision of farmers
2. Analysis of means
3. Analyses of G x E
4. Breeding goal and farming style
5. Analyses of the situation and possibilities

Vision of the farmers:



I = conventional

II = conv., no ET,

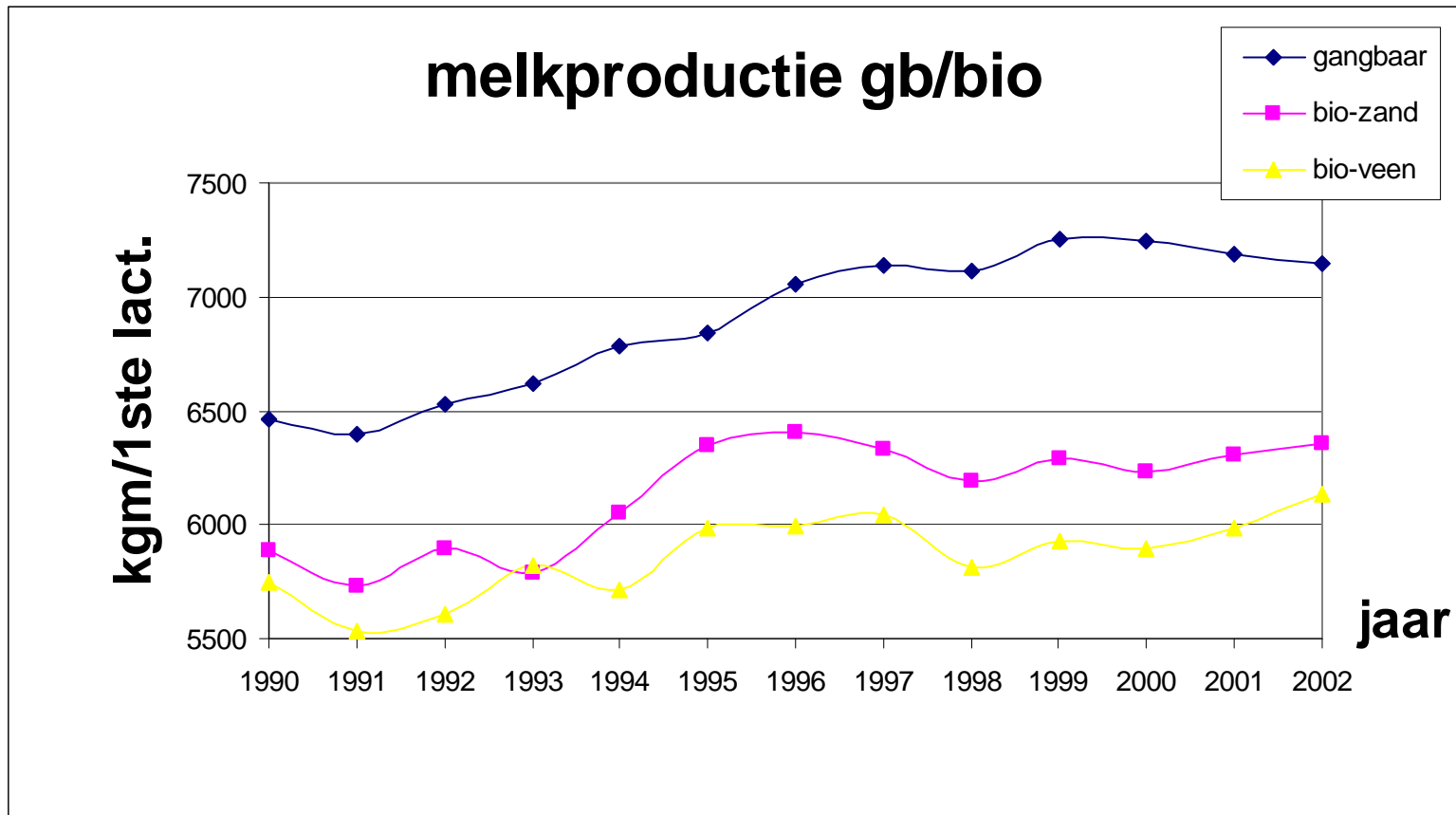
III = conv, adapted

IV = organic programme

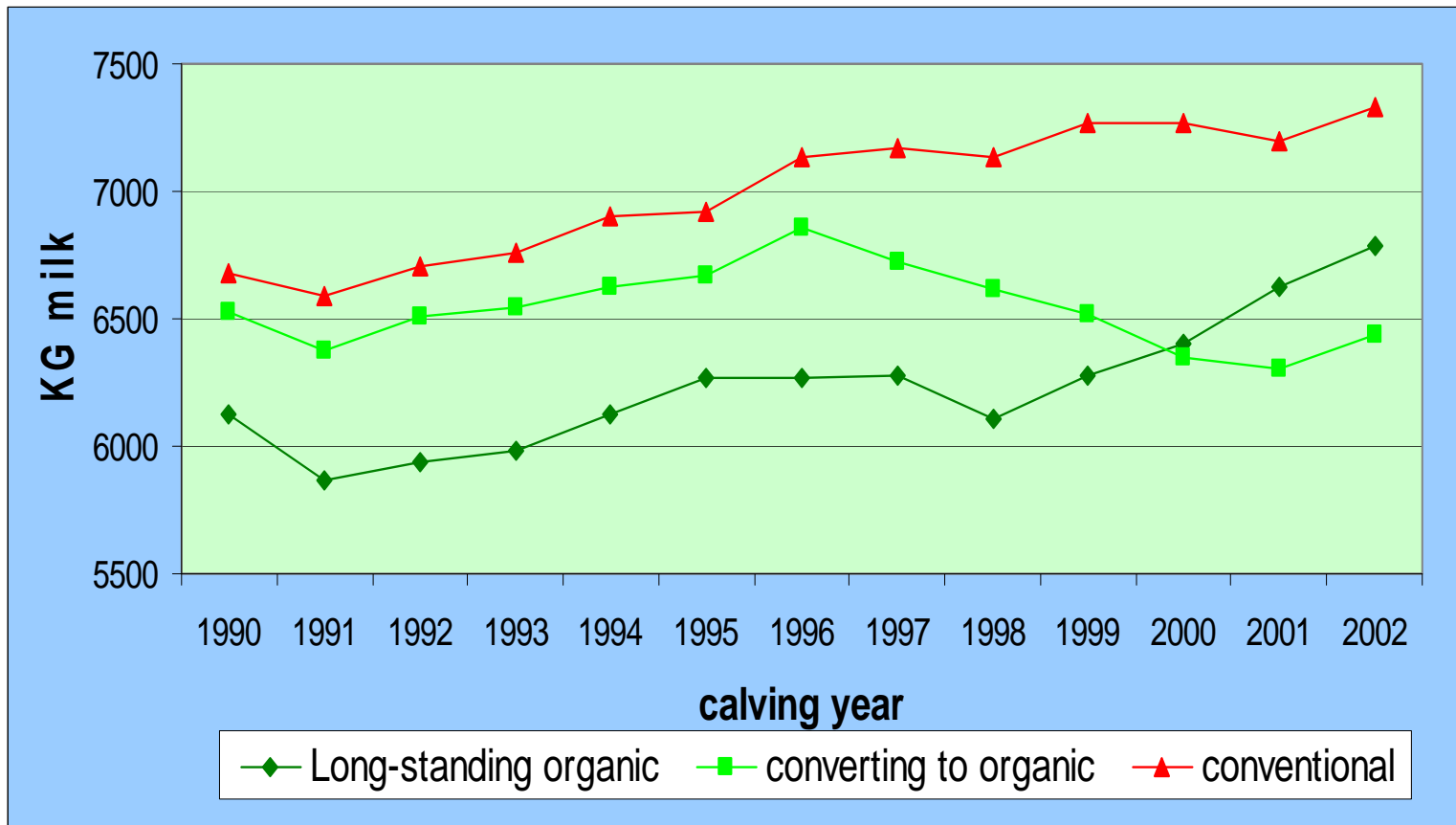
V = regional breeding

VI = farm based breeding

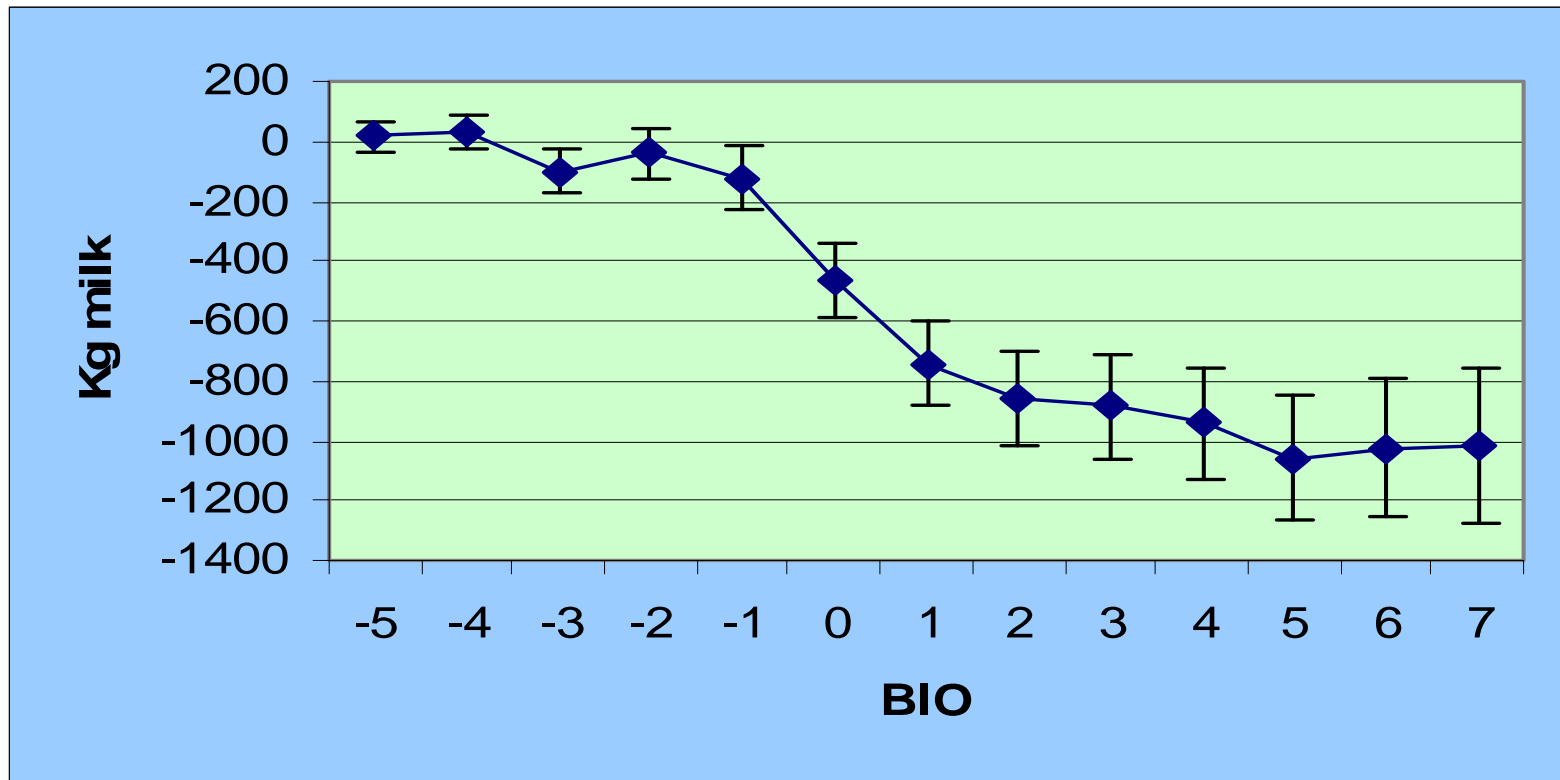
Phenotypic trends:



Phenotypic trends:



Genetic effect of conversion:



$$Y_{ijkl} = \mu + H_i + YS_j + \beta_0 * AFC_{ijkl} + \beta_1 * (AFC_{ijkl})^2 +$$

$$\beta_3 * DO_{ijkl} + \beta_4 * (DO_{ijkl})^2 + BIO_k + Animal_l + e_{ijkl}$$

Effect on cows:



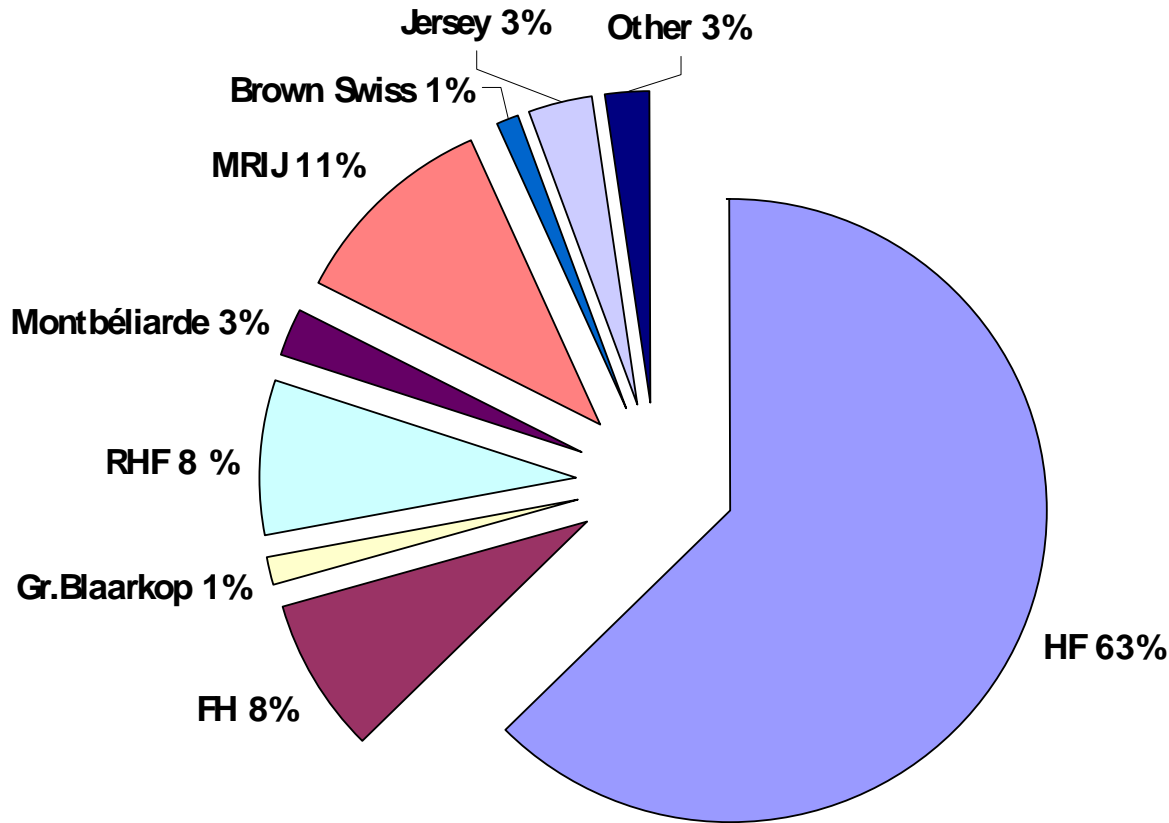
Effect on cows:



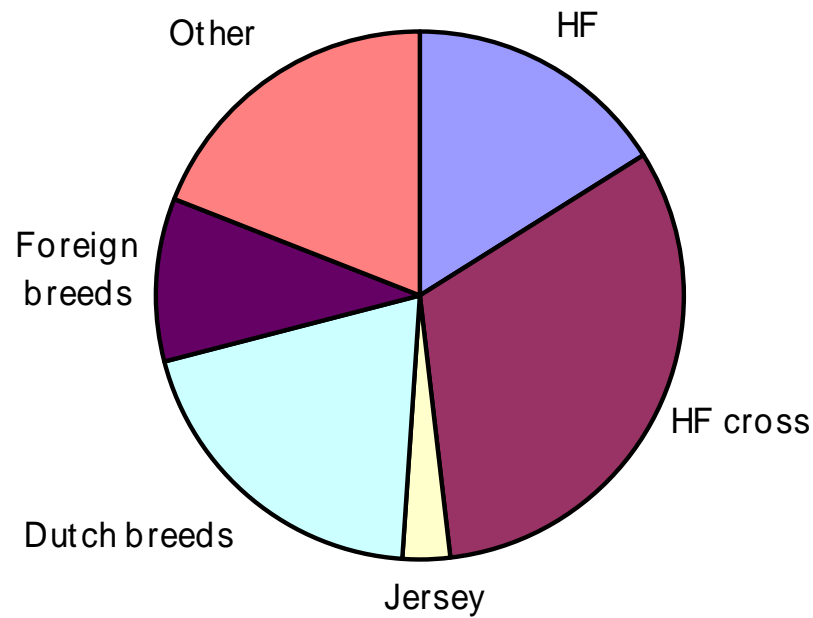
Effect on cows:



Breeds in the Netherlands 1999



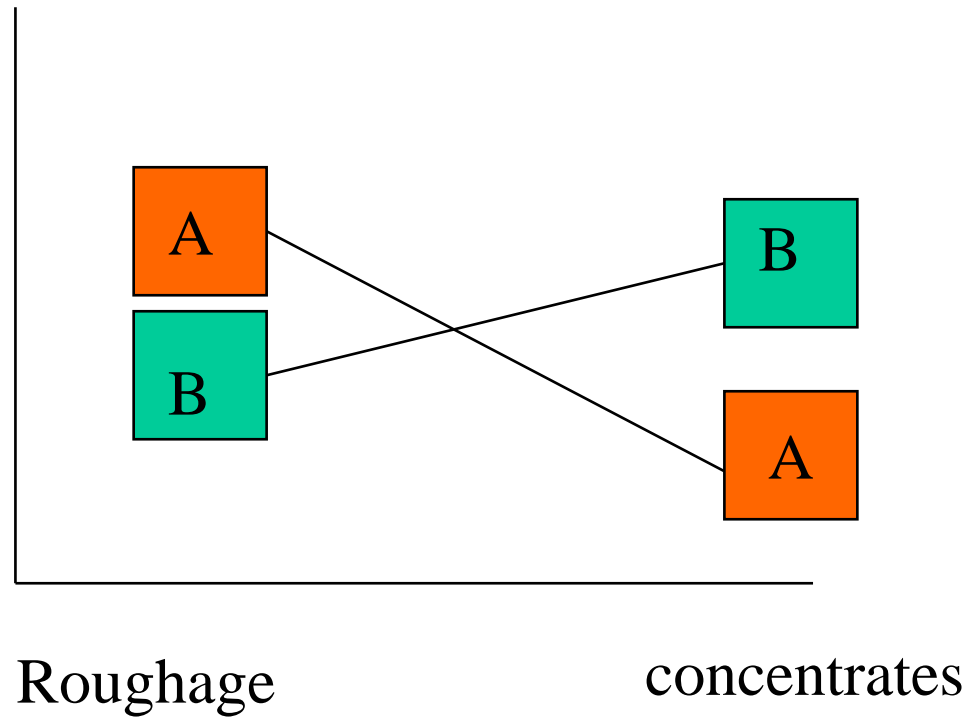
Breeds aimed for in 2005



Genotype-environment interaction

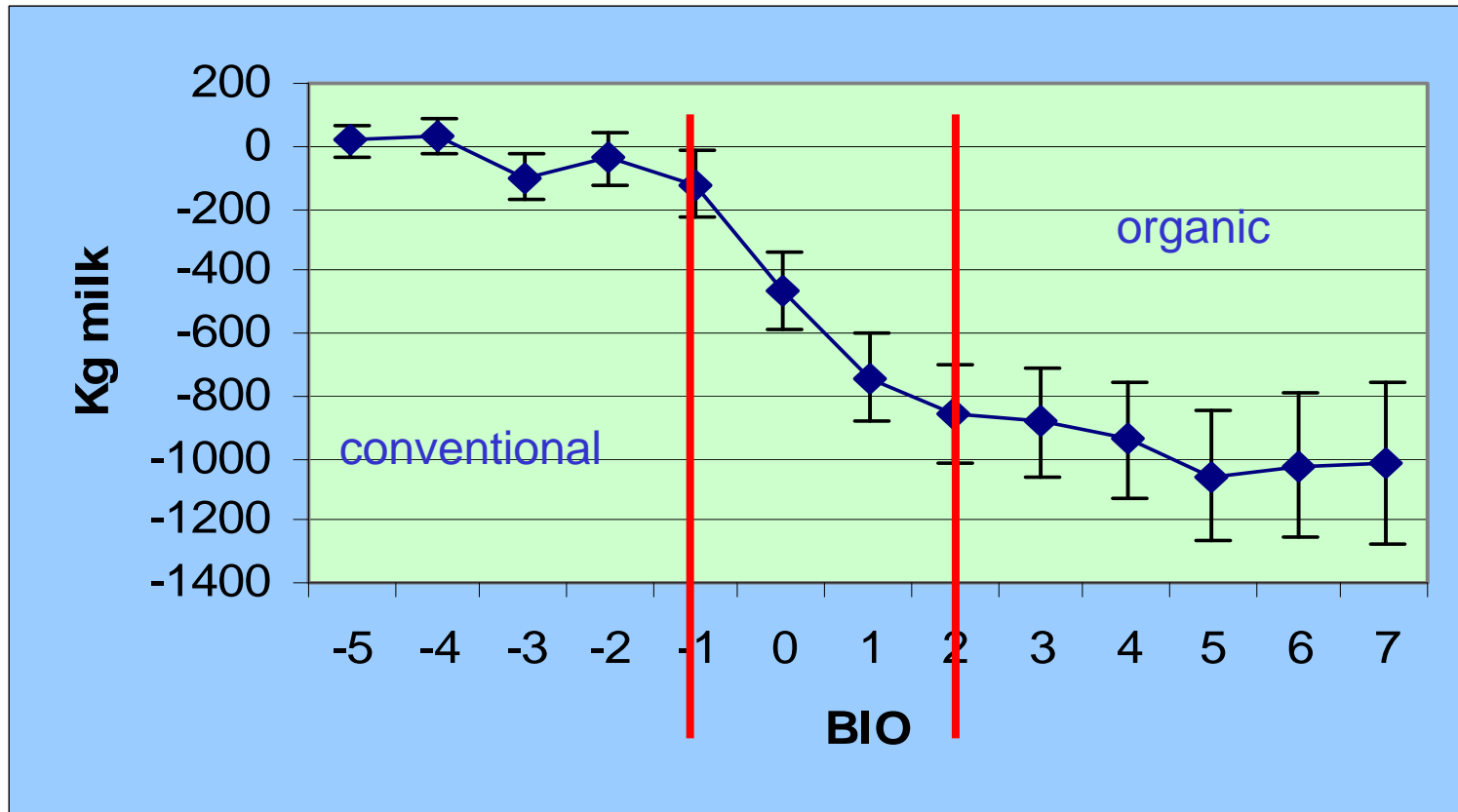
G x E

Milk
production



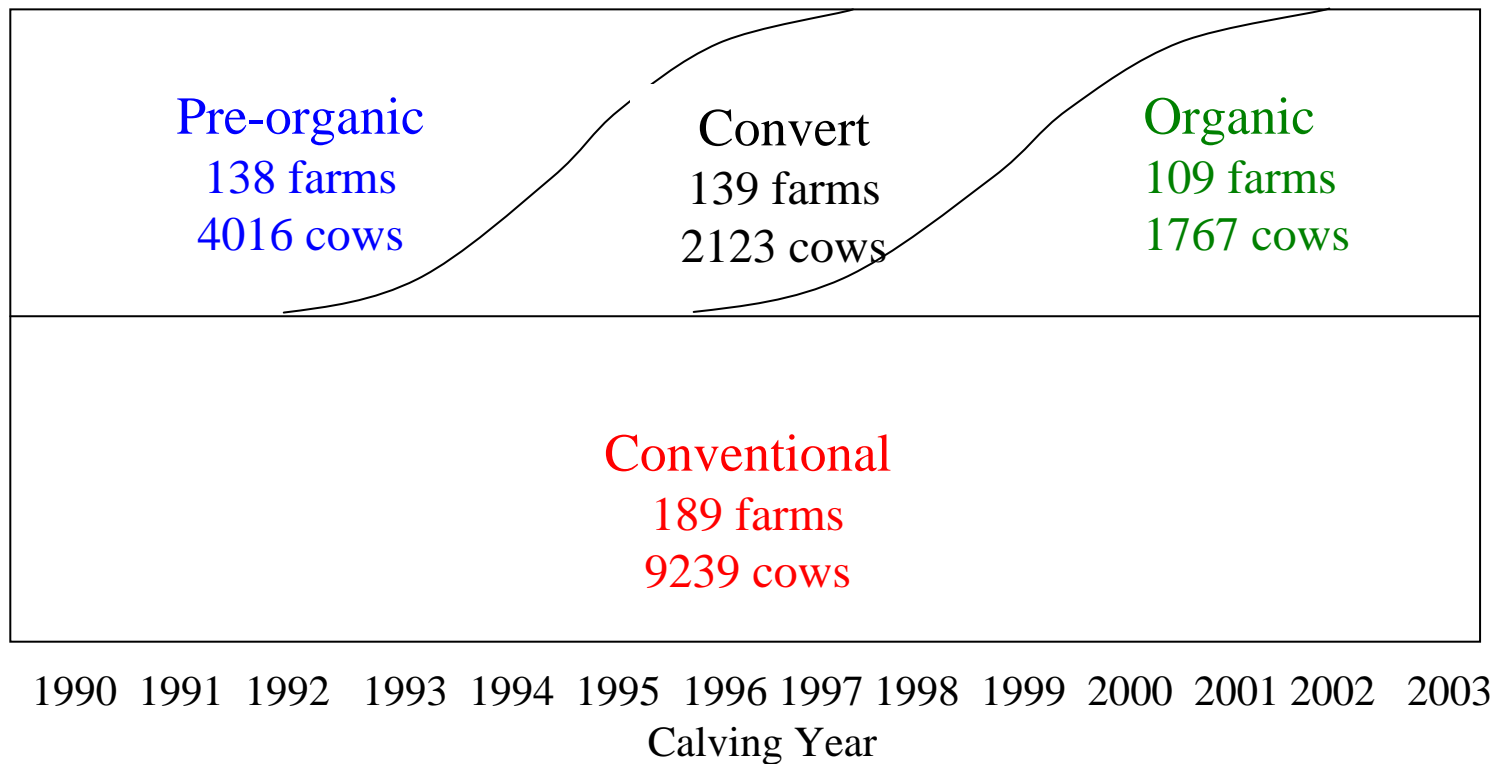
Genotype-environment interaction

G x E



Genotype-environment interaction

G x E



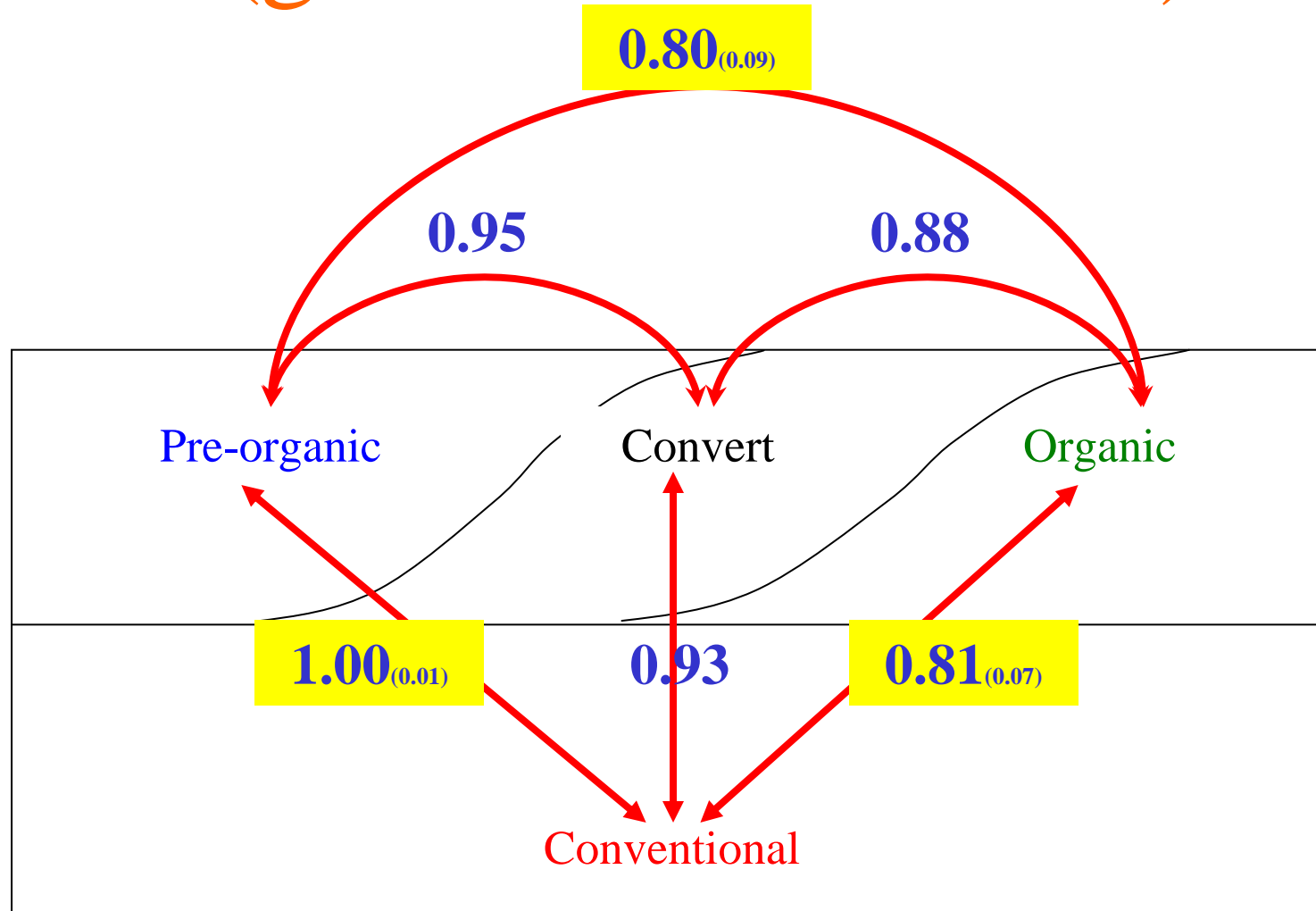
Mean values for Holsteins per environmental group

	conventional	pre-organic	converting	organic
Kg Milk (sd)	7156 (1203)	6991 (1219)	6622 (1145)	6440 (1158)
% fat (sd)	4.36 (0.46)	4.32 (0.45)	4.31 (0.45)	4.29 (0.46)
% protein (sd)	3.45 (0.19)	3.44 (0.20)	3.37 (0.20)	3.34 (0.19)

Heritabilities (h^2) per environmental group

	Conventional	Pre-organic	Converting	Organic
Kg milk	0.48	0.39	0.59	0.70
Fat %	0.79	0.83	0.87	0.84
Prot. %	0.72	0.76	0.77	0.68

GxE for milk yield (genetic correlations)



Conclusions:

- Important effect of GxE for milk yield, and fat and protein yield.
- What is effect on reproduction and SCC?
- Effect will increase with lower input concentrates

Effect on yield is lower for other (cross)breeds?

Different farming strategies → different breeding goal?

we compared:

Specialized Milk vs. Multifunctional farming

High input vs. Low Input farming

Multifunctional vs. Specialized farming farm descriptives:

59
51 ha
282 tons milk quota
47 milking cows
5892 kg milk/cow
980 kg concentrates/cow
61% cubicals
38% Holstein cows

82
52 ha
367 tons milk quota
56 milking cows
6512 kg milk/cow
1155 kg concentrates/cow
78% cubicals
70% Holstein cows

Low Input vs. High Input farming

farm descriptives:

48

53 ha

288 tons milk quota

48 milking cows

5811 kg milk/cow

674 kg concentrates/cow

65% cubicals

44% Holstein cows

63

56 ha

365 tons milk quota

55 milking cows

6577 kg milk/cow

1381 kg concentrates/cow

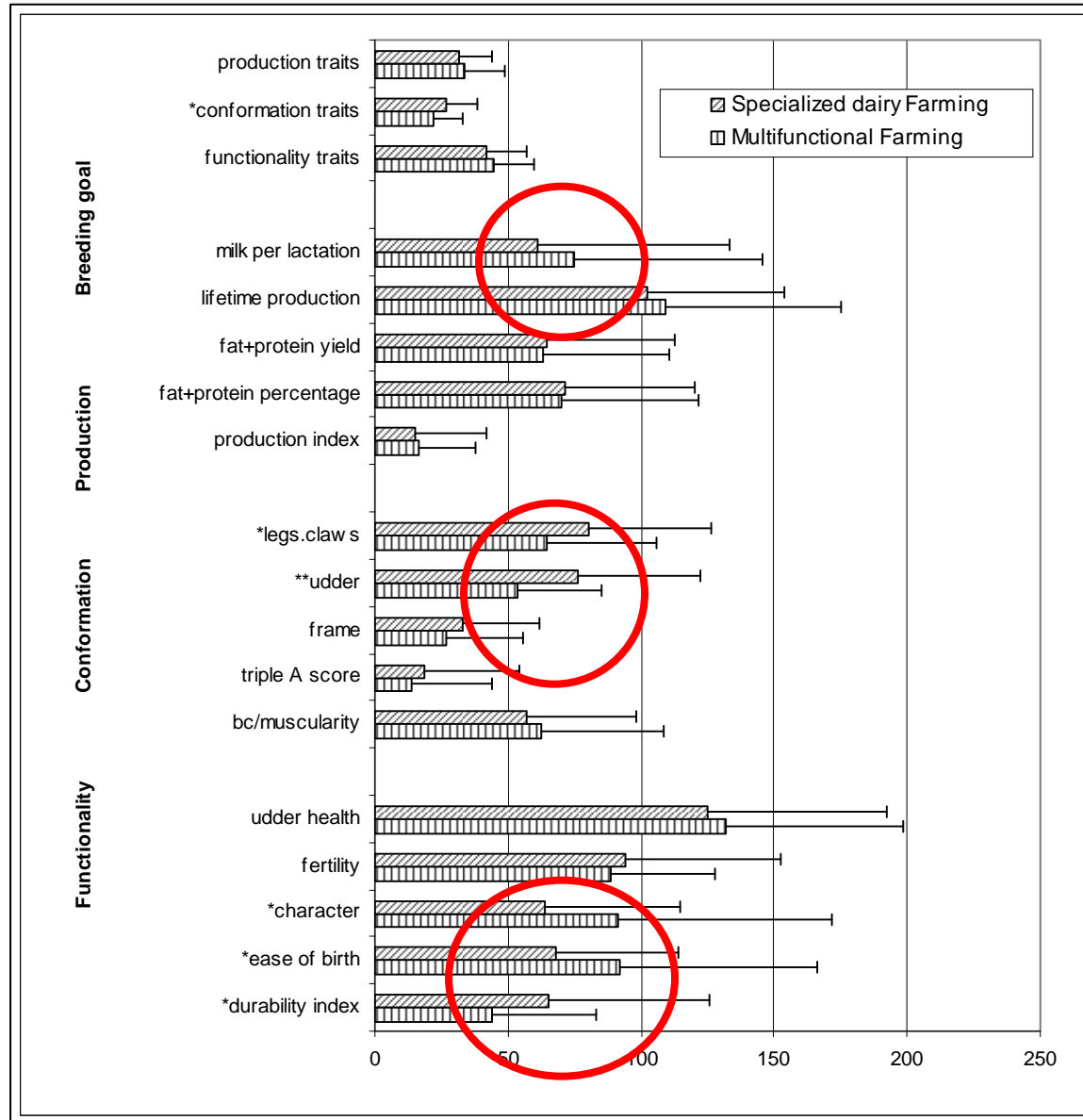
70% cubicals

68% Holstein cows

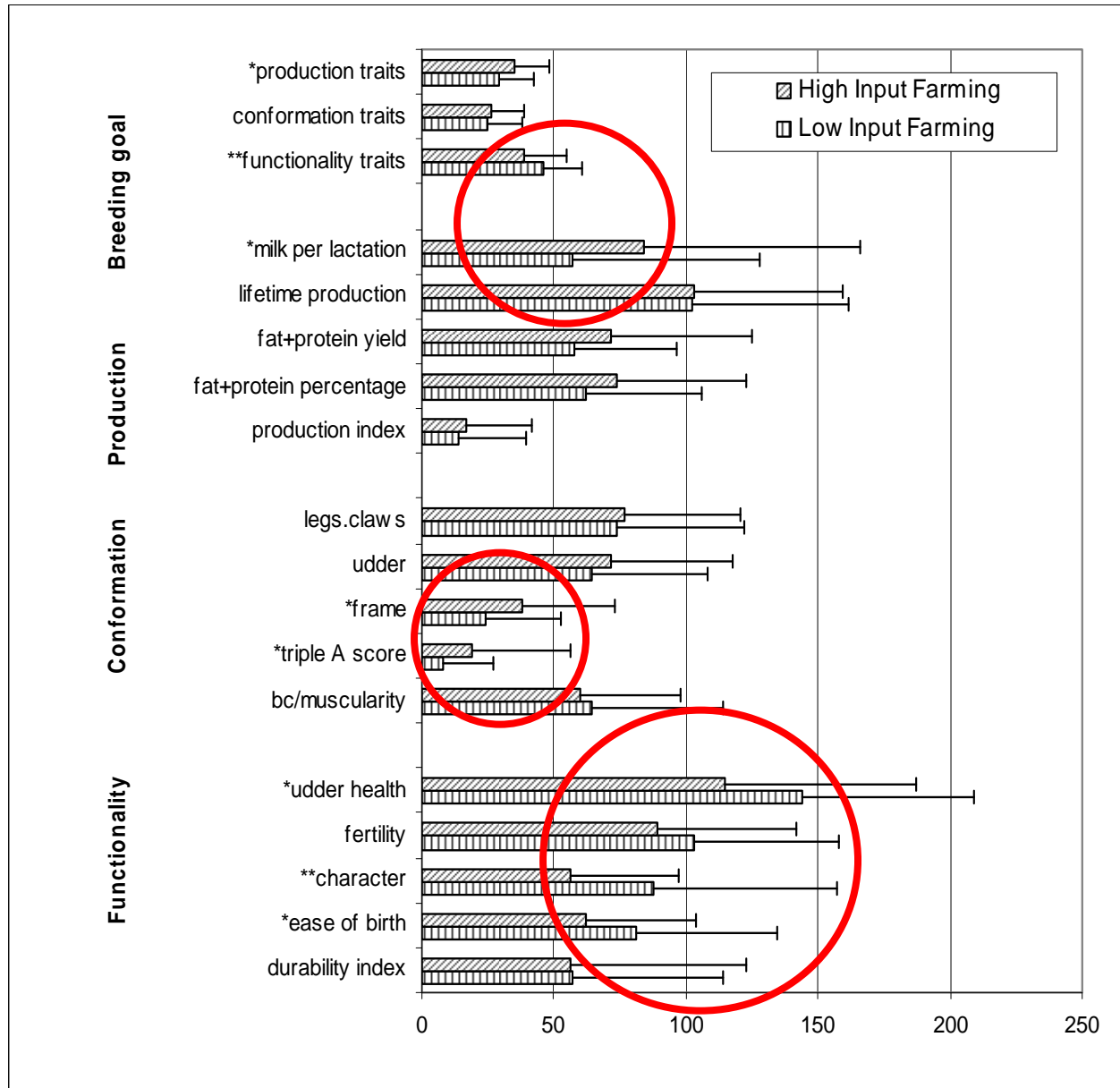
Specialized vs. Multifunctional farming and High input vs. Low input farming:

- Overall similar breeding goal!
 - 42 % Multifunctional traits
 - 31% Production traits
 - 27% Conformation traits

Specialized vs. Multifunctional farming

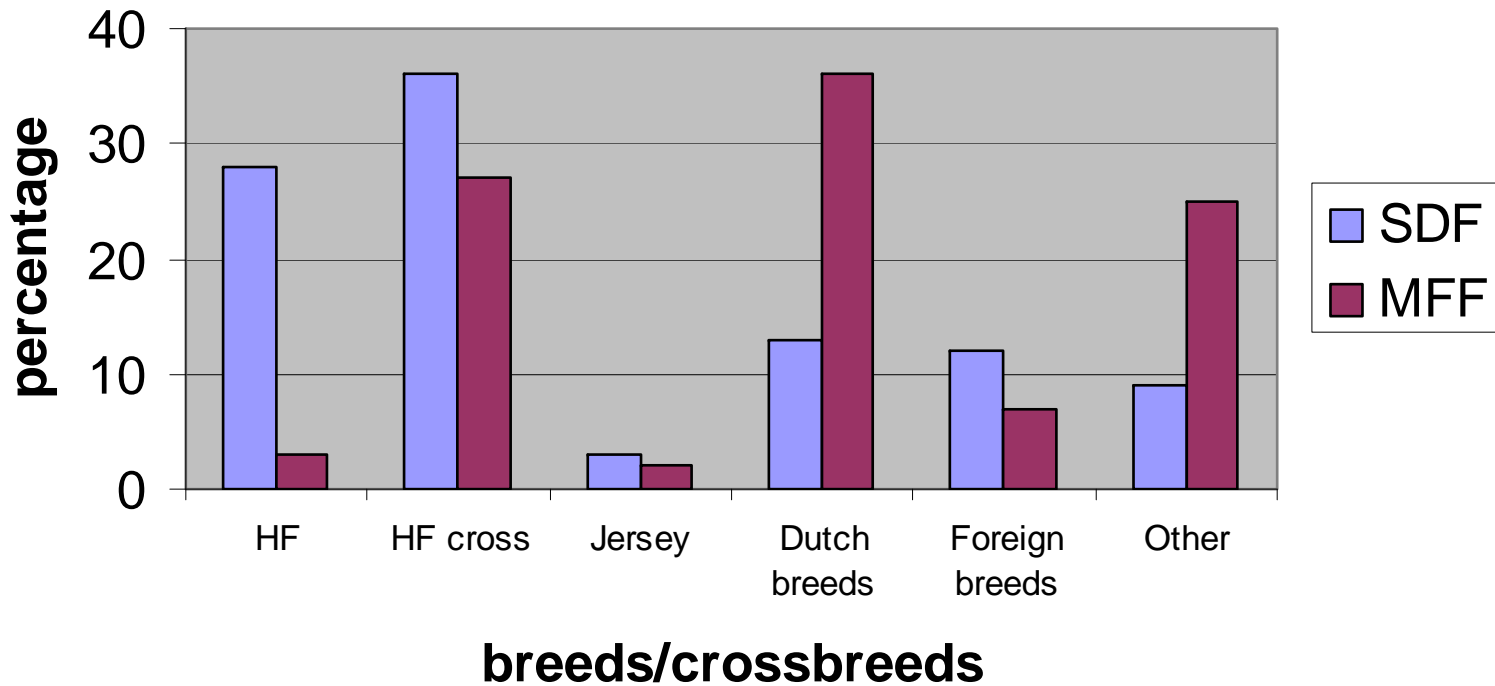


High Input vs. Low Input farming

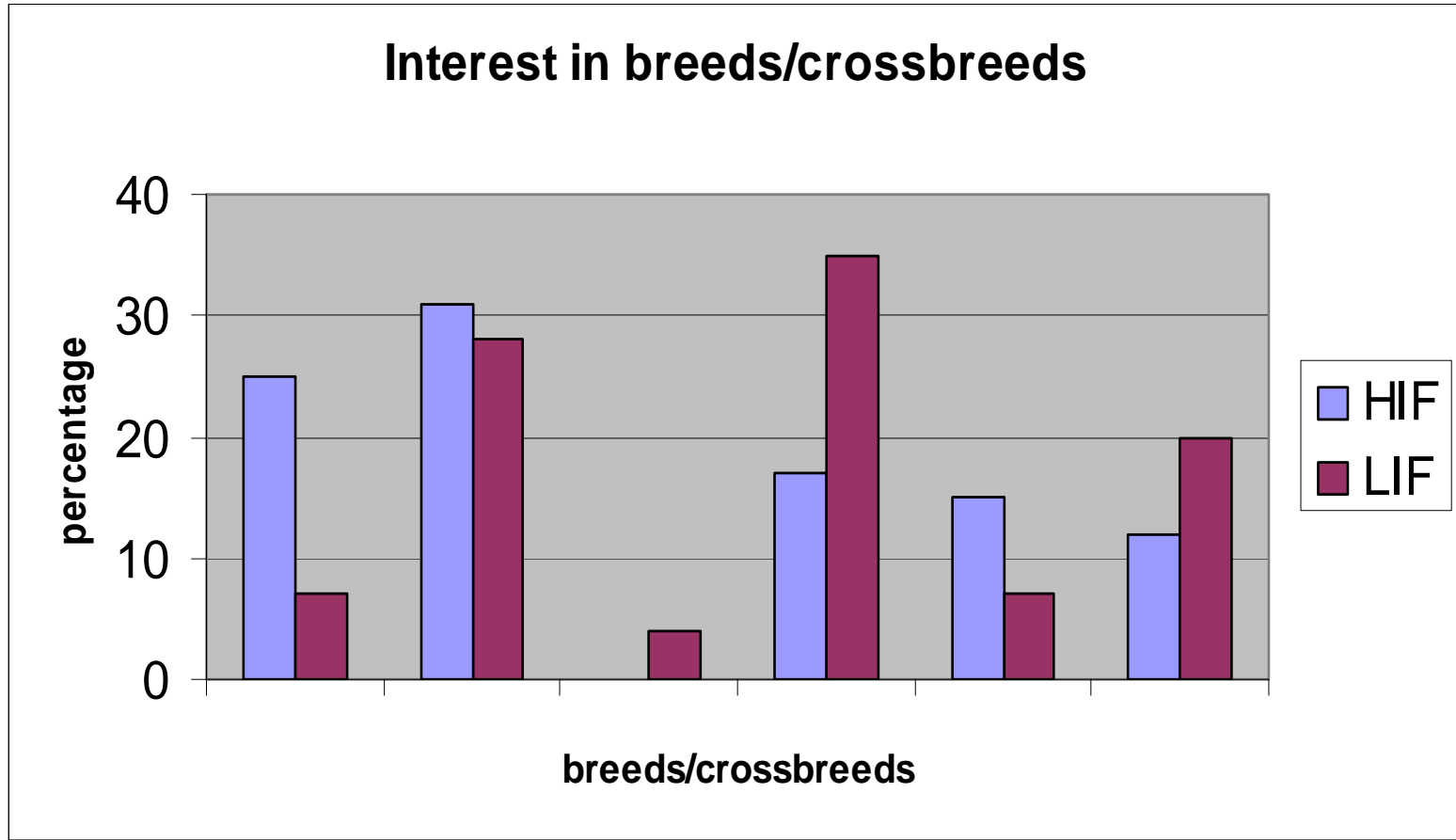


Specialized dairy vs. Multifunctional farming

Interest in breeds/crossbreeds



High Input vs. Low Input farming



Conclusions:

- Different farming strategies in OF
- Overall similar breeding goal independent from strategy
- Farmers try to reach breeding goal by selection of (cross)breeds
- It is “Learning by doing”, while no information is available yet.

and:

- Holsteins are not done anymore?
- You have to be different as an organic farmer?
- Old native breeds fit to the principles of organic farming?

and more interest in natural
breeding (up to 24 %!)



Analysing the situation:

- Three possibilities (routes):
 - Adapted conventional breeding
 - Organic breeding programme
 - Natural breeding/on farm breeding

Analysing the situation:

- Discussion about:
 - Naturality
 - Selecting suitable cow type
 - Demand and supply
 - Sector's public image
 - Ownership / community building
 - Costs and benefits

Naturality:

- Also AI or back to natural service
- Breeding programmes without ET
- New technologies: Sexing sperm
- Future: Cloning and Cisgenesis in the conventional programmes?
- Introduction of genomics

Selecting suitable cows:

- Size of the breeding program
- Type of breeding system ('cold'?)
- Use of AI, genomics, sexed semen
- Breeds/ cross breeds, new breed?

Numbers of cows:

Country	No. of organic milking cows
The Netherlands	16,182
Belgium	8,297
Germany	85,000
United Kingdom	214,276
Ireland	850
France	62,140
Italy	58,443
Scandinavia	49,882
Total	495,070

GxE and reliability:

G x E		No. of daughters required per trait**			
Genetic correlation r	r ²	Reliability r ² _{AI} at conventional reliability 90% (80%) *	Milk h ² = 0.35	SCS h ² = 0.10	CI h ² = 0.07
0.70	0.49	44% (39%)	9 (7)	31(25)	44 (36)
0.80	0.64	58% (51%)	15 (11)	54 (41)	78 (59)
0.90	0.81	73% (65%)	28 (20)	105 (72)	152 (105)
1	1	90% (80%)	94 (42)	351(156)	505 (225)

$$r_{AI}^2 = (0.25 * n * h^2) / (1 + 0.25(n-1)h^2)$$

:Demand and supply

- Availability of ET-free bulls
- Difference in breeding goal
- Genetic trend!
- Supply of conventional breeders
- Size of populations/variation

Sector's public image:

- What do consumers know / think
 - Closed production chain
 - Animal welfare
 - Use of technology
 - Biodiversity
- Consumers getting more involved!

Ownership-community building:

- Who is going to make the first step
- Organic or conventional
- Knowledge
- New rural-breeding networks for the organic movement?

Costs and benefits:

- Type of breeding structure
- Size of population
- Genetic progress – important traits

Conclusion:

- A complex situation
- Process of joined learning and innovation
- New knowledge and spreading it
- Embedding innovations
 - Pilot studies.

Concluding remarks:

- Better rules needed
- Focus on diversity
- Organic breeding for all farm species

Now working on:

- Breeding programmes
- Farm based breeding
- European association Eco-AB
- First IFOAM world congress about plant and animal breeding
- Organic breeding of cattle, sheep, goats and laying hens

thank you for attention.



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